

MICRONUTRIENTS IN NUTRIGENOMICS

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Nutrients in gene expression:

Genetic variation, dietary sodium and the response of blood pressure:

Essential hypertension is a common disease, Association between the parental blood presume, genetic, nutritional and other environmental factors, (obesity, sodium chloride, alcohol, low potassium, low calcium, low omega –3 fatty acid intake, stress, physical activity etc) interact in the development of hypertension. Variations in the blood pressure are due to combined effects of many genes. As result different individuals, even within the same family may be hypertensive due to combined effects of many genes. Patients with low plasma rennin respond to salt restriction. Genetic differences most likely are responsible for salt sensitivity. Only half of the patients with essential hypertension is salt sensitive, therefore a general recommendation to reduce salt intake is not appropriate.

Genetic analysis in human population supports an important role for the renin – angiotensin system in the hypertensive phenotype. Angiotensin II regulates blood pressure and salt retention. Molecular variants of the renin substrate angiotensinogen have been found to cause an inherited predisposition to essential hypertension. Individuals with certain angiotensinogen gene (AGT) variants associated with hypertension had significant difference in plasma concentration of angiotensinogen.

Vitamin D and gene connection:

The activity of vitamin D in the body depends on the vitamin D receptor (VDR), a particular type of cell structure that influences the behavior of numerous genes effecting cell growth, immunity and bone development. The VDR itself is controlled by VDR gene. However, defects in the VDR gene limit its ability to efficiently use vit D. The effect is somewhat like a row of falling dominos, because people with VDR defects cannot properly utilize vit D. They are essentially at risk of being deficient in vitamin D, even if they consume “normal amounts of it”. This genetic bottleneck impairs the activity of genes that

ultimately depend on the VDR. Any variation in the VDR gene doubled the risk of breast cancer.

Some researcher found that women with low blood levels of vitamin D were five times more likely to develop breast cancer. Other human studies, as well as those with animals and cells have found that vit D may protect against colon, pancreatic and prostate cancer.

Vitamin C and heart failure:

Human embryonic stem cells are essentially generic cells. They are among the most fundamental unspecialized living cells, which serve, as “parent cells” for what will eventually become an entire body. In a developing fetus small number of stem cells divide and give rise the trillions of highly specialized cells, including those that form the heart, lungs, brain and other organs.

In one experiment 880 chemical compounds were tested for their effect on embryonic stem cells derived from mice. Stem cells pretreated so that they would emit a green color if they grown into heart muscle cells. Of all 880 compounds, which are approved for use in people, only one promoted activity in the stem cells and that was vitamin C.

In the same experiment the embryonic stem cells were treated with vitamin C for 12 days. During this time large numbers of the stem cells began transforming into heart muscle cells called myocytes. The cells even began to beat rhythmically as normal heart cells do. In addition vitamin C promoted the expression or activation of several cardiac genes, which would have further directed the behavior of the heart cells. The study findings are significant for number of reasons. According to the research embryonic stem cells with vitamin C could facilitate the large-scale production of heart cells, which some day might be administered to treat heart failure (Takashashi *et al.*, 2003)

Omega 3 fish oils protect against “Heart disease” gene:

Considerable researches as shown that the omega 3 fatty acid found in fish oil can reduce inflammation, decrease blood pressure prevent arrhythmias and lower the risk of heart attack.

New researchers have reported the diet high in omega – 3 fish oils can also protect against a particular genetic predisposition of heart disease. But much of the risk of heart disease possessed by the ALOX5 variations was either amplified or mitigated by diet. People who ate diets rich in omega-6 fats specifically linoleic acid, arachidonic acid were far more likely to have narrowed arteries and higher level of inflammation. However people who

consume large amounts of omega 3 fish oils i.e., eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) had no increased risk of heart disease or inflammation.

Dwyer (2004) reported that variation in the ALOX5 gene results in increased risk for heart disease. This gene programmes the construction of 5 lipoxygenase an enzyme involved in making inflammation-promoting molecules. The persons having variation in the ALOX5 gene increased the risk of blood vessel narrowing, a sign of heart disease. The ALOX5 was associated with substantially higher level of C reactive protein, a marker of inflammation and a risk factor for heart disease.

Omega 6 and omega 3 fatty acid compete with each other to use the 5-lipoxygenase enzyme. Increasing consumption of omega 3 fatty acid reduces the production of pro inflammatory omega 6 molecules, which are involved in heart disease.

Folic acid and gene Expression:

MTHFR (5,10-methylene and tetrahydrofolate reductase) is a key enzyme, which directs folate from the diet either to DNA synthesis or to homocysteine remethylation. Homocysteine remethylation is the source of methyl groups for DNA. Which are added to an existing DNA chain. DNA methylation is used by the cell as a mechanism for the control of gene expression as well as DNA repair, and therefore has an important role in cellular function and development. Lower activity of this enzyme leads to a build up of homocysteine in the blood stream, which has been linked to cardiovascular disease, venous thrombosis and neural tube defect. Both vitamin B₁₂ and B₆ involved in methylation pathway and low levels in the body will decrease the efficiency of the pathway. There is substantial evidence that individuals with the MTHFR polymorphism C677T and A1298C have increased requirements for folate and they tend to respond rapidly to folate supplementation.

There is much evidence linking homocysteine levels to increased risk of cardiovascular disease and there are several examples where folate supplementation in carriers of the variant MTHFR enzyme has a direct and demonstrable effect on lowering the homocysteine level.

The MTHFR 677TT genotype had a significantly higher risk of CHD, particularly in the setting of low folate status. These results support the hypothesis that impaired folate metabolism; resulting high homocysteine levels are casually related to increased risk of CHD.

Effects of Zinc on gene:

Improved immunity is one of the benefits of diet adequate levels of zinc which is abundant in red meats and some seafood. Some genes were turned off by zinc while others

were turned on. Those that were turned off by less zinc were associated with the activation of white blood cells that protect against a variety of infection. When zinc was provided those genes were found on.

Antioxidants protects the DNA from damage:

Damage to DNA (subsequently to genes and chromosomes) also be caused by unstable molecules known as free radicals. Most free radicals are formed as a byproduct of burning food for energy and fighting infections, but others are generated by ultraviolet sunlight, cigarette smoke, and pollutions. Free radicals delete sections of DNA, rearrange it or cut into pieces, and the end result is analogous to typographical errors that distort DNA's instructions. Surai (2002) reported that ROS is responsible for about 10,000 base modifications per cell / day.

The DNA mutations eventually become catastrophic and are the reason why are the living creatures age. For example the cells of 70 year old man contain for more damaged DNA. Work less efficiently and outwardly look very different from the cells of a 13-year-old girl. Sometimes the errors in DNA create widely growing unstoppable cancer cells.

The likelihood of developing cancer and other diseases increase with age. Principally because DNA has accumulated more damage and is more likely to malfunction. The aging of DNA is inevitable. But the process doesn't always occur at the same pace. Furthermore, a variety of experiments, some with people have shown that nutritional supplements can reduce the rate of DNA damage and in doing so, slow the age related changes to cells. Chief among the nutrients are antioxidants, including vit-C and E, which neutralize free radicals.

Lung cancer and cruciferous vegetables:

Researchers founded that 70% of reduction of lung cancer for individuals who possessed an inactive version of two particular genes, when they consumed cruciferous vegetables at least once a week.

In the future you'll be able to go to a lab and complete a set of genetic tests to identify your personal foods to eat and foods to avoid and recommendation of dietary supplements help to prevent your diseases.

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